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**Ozsoylu et al.**

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(54) **VEHICLE BRAKING SYSTEM WITH ELECTRIC BRAKE BOOSTER**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(71) Applicant: **AUTOLIV ASP, INC.**, Ogden, UT (US)

6,957,871 B2 \* 10/2005 Maki ..... B60L 7/26  
303/113.3  
2003/0214180 A1 \* 11/2003 Kusano ..... B60T 8/44  
303/116.2

(72) Inventors: **Suat Ozsoylu**, Rochester Hills, MI (US);  
**Ron Posa**, Commerce Township, MI  
(US); **Michael Yang**, Westland, MI (US);  
**Karen Boswell**, Freeland, MI (US)

(Continued)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **AUTOLIV ASP, INC.**, Ogden, UT (US)

DE 102010038548 A1 2/2012  
WO 2012019802 A1 2/2012

OTHER PUBLICATIONS

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International Search Report regarding International Application No. PCT/US2014/014846, ISA/US dated May 21, 2014.

(Continued)

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*Primary Examiner* — Robert A Siconolfi

*Assistant Examiner* — San Aung

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(74) *Attorney, Agent, or Firm* — Stephen T. Olson; Harness, Dickey & Pierce, P.L.C.

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See application file for complete search history.

(57) **ABSTRACT**

A braking system for a vehicle is operative to apply a friction brake force to at least one wheel of the vehicle. The braking system includes a master cylinder in fluid communication with a reservoir of brake fluid and in fluid communication with the hydraulic brake device. According to one aspect, the braking system includes an electric brake force generator which moves the brake fluid within the master cylinder to deliver brake fluid to the friction brake device in response to a first predetermined displacement of a brake pedal. The electric brake force generator includes a housing defining a boost chamber filled with brake fluid and in fluid communication with the reservoir of brake fluid and further includes a drive arrangement for creating pressure in the boost chamber. In accordance with another aspect, the braking system includes a mechanical brake force generator is disposed between a brake pedal and a primary piston of the master cylinder which is operative to actuate the master cylinder in response to a predetermined displacement of the brake pedal.

**13 Claims, 6 Drawing Sheets**

